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Patentanmeldung Nr. | Patent application No. | Demande de brevet n°

00128352.2

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Blatt 2 der Bescheinigung
Sheet 2 of the certificate
Page 2 de l'attestation

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The invention concerns methods and devices for ATM transmission

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The invention concerns methods and devices for ATM transmission.

'AAL type 2 switching' as a resources-saving embodiment of ATM based transmission requires ATM- connections ('virtual channel connection', VCC), which are called paths ('AAL type 2 paths') in the following, as a carrier of 'AAL type 2'-connections . The paths can be provided as permanent paths in the network ('PVC VCC'), or as switched paths ('SVC VCC'), or as both installed and switched ('soft PVC VCC').

It is not yet known to transport ATM AAL2 connections over other than permanently installed paths.

It is an object of the invention to enable network elements to set up SVC-paths in a flexible, dynamic and anticipatory way in a network according to the traffic volume, and to release SVC- paths again when traffic volume is decreasing.
The object is achieved by the invention as set forth in the claims and the description.

Establishing and disintegrating of paths is controlled by means for resources management that are preferably provided near an access point or means of the network. An important element is a means for recognizing (using threshold values that are variable or preset) whether the currently available capacity is sufficient or whether the current capacity is too high. This is preferably examined each time when resources are requested for establishment of an 'AAL type 2'-connection ('call by call') or/and when resources of an 'AAL type 2'-connection are released. According to the result of this verification the means for resources management triggers or starts setting up a path or releasing a path or it does nothing. The switching functions for establishment and disintegration of paths are carried out by special switching components provided for this tasks using suitable signalling. Those switching components, and also other intermediate switching components involved in the set-up of calls, may use network-learned routing information (that is exchanged by a

suitable protocol) or administered routing information for the set-up of new paths. Moreover, such routing information may also be used by those special switching components when choosing a path to be released.

One advantage of such solution is the reduction of the amount of administration to be provided by an operator of the network. An other advantage is the adaption of the ATM based virtual transmission paths of a network according to the current and/or predicted traffic volume by (elements of) the network. The invention allows to provide failure- free and in- time exactly those transmission paths and/ or capacity that are currently necessary for processing of "AAL type 2"- transmission- traffic.
The following description of embodiments of the invention shown in the enclosed figures discloses further possible features and advantages of the invention.

List of Figures and Tables

Switched virtual channel connections as pathes for AAL type 2 switching

AAL type 2 switching depends on virtual channel connections (VCC) as bearers of AAL type 2 connections. The VCCs may be represented by permanent VCCs (PVC), by switched VCCs (SVC), or by switched PVCs (also called soft PVCs). The description puts its focus on SVCs. If soft PVC implementation is desired, the ability to switch virtual channels is a prerequisite.

The advantage of using switched virtual channels rather than PVCs obviously is a reduction of administrative efforts. An operator is not forced to initially build up PVCs within the network, and to continously measure the traffic for the purpose of keeping PVC path resources up to date. The network dynamically and automatically establishes the AAL type 2 pathes as required by the traffic flows through it.

Mixed operation shall however be supported. Operators of small networks may prefer the PVC solution. Others may decide to use PVCs towards the access side (connecting RNCs), but are favouring SVCs meshing the network.

Functionality

Signalling

Common aspects

Consulting the standards, ITU-T amendments to Q.2931 define additional information elements or extensions to existing ones such as the AAL parameters IE or the generic transport identifier IE to support AAL type 2 switching using SVCs.

ATMF papers clearly suggest DSS2 signalling protocols, such as UNI signalling 4.0 (which may be considered identical to Q.2931), or AINI and PNNI.[1]

[1] It is not intended to play the role of a PNNI network. Thus PNNI specific nodal or network functions, such as 'source node routing' or 'network topology update protocols' are not supported. PNNI support as mentioned above is restricted to mere basic signalling aspects.

The signalling functionality of ESIS(DSS2) and its protocol handler (PrH) supports the above signalling types, and may be reused as had been implemented into the call processing software of Mainstreet Xpress (36190).

AINI signalling has been developed by the standardization bodies for inter-network communication, especially between PNNI and non-PNNI networks. Since nobody talks about ISUP in the context of SVC pathes for AAL type 2 switching, the recommendation (and furthermore the working assumption) is to implement UNI and AINI signalling.

So far there are no standards existing which specify the procedures to be used when setting up or releasing AAL type 2 pathes based on SVCs.

The protocol stack

Signalling is based on the commonly used protocol stack as shown in Figure 1.

Associated versus non-associated signalling

Associated signalling:

The layer 3 signalling entity exlusively controls the VCs in the VPC which carries its signalling VC.

Non-associated signalling:

The layer 3 signalling entity controls the VCs in the VPC which carries its signalling VC, and may control VCs in other VPCs.

Quoting Q.2931:

"The network and user shall support the non-associated signalling procedures, and may as an option support the associated signalling procedures. The associated signalling procedures are used only by bilateral agreement between the user and the network."

Non-associated signalling is the default signalling procedure supported by ESIS, and hence will be available in our environment. The question whether or not associated signalling is to be supported depends on requirements possibly coming up when interfacing to ATM based transit networks.

Resource assignment (Figure 2)

The connection identifier information element specifies the assignment of VPCI and VCI.

When setting up a new AAL type 2 path, the originating side shall assign VPCI and VCI, by default using "exclusiveVPCI, exclusive VCI". The succeeding end of the link either accepts or rejets the setup (no negotiation).

When receiving a setup from another network, different variants may be used by that network. Those variants are supported in accordance to the standard.

In all cases, the originating endpoint is considered to be the 'owner' of the path.

The setup message

Figure 3 shows the general structure of a setup message. Not all information elements are listed. Some information elements with special significance to AAL type 2 switching are explained in more detail.

The AAL parameters IE according to Figure 4 denotes AAL type =2, the maximum CPS-SDU size is set to 45, and the maximum number of multiplexed channels will be 248.

Assuming that AAL type 2 switching is based on recommendation I.366.1, the SSCS type will be set to 16 (SAR). Within the SAR parameter, flag S1 indicates if the assured data transfer mechanism is used, flag S2 indicates if the transmission error detection mechanism is selected. Finally the forward and backward maximum SSSAR-SDU size may be specified.

Except of the AAL type field, all fields are optional, which is achieved by the field identifier mechanism. If fields are omitted, certain defaults have to be assumed, as specified by Q.2931.

The ATM traffic descriptor IE according to Figure 5 contains the forward and backward peak cell rates for cell loss priority 0+1. The peak cell rates for CLP=0 is optional and not required. The same holds for other fields, which are relevant only for variable bit rates or non-realtime traffic types (such as sustainable cell rates, maximum burst sizes, tagging options, among others).

The broadband bearer capability IE according to Figure 6 indicates bearer class A. The 'susceptible to clipping' information in field F1 is set to 'not susceptible to

clipping', and the user plane connection configuration in field F2 is set to 'point-to-point'.

Within the quality of service parameter IE, the QoS class according to Figure 7 is set to 'quality of service not explicitely indicated' for both directions, which means that sufficient information for the traffic contract can be extracted from the ATM descriptor and the broadband bearer capability.

The generic identifier transport IE contains the path identifier according to Figure 8:

The calling and called party number IEs according to Figure 9 identify the source and target network element, for example by their AESA address.

With that, we have specified quite an ordinary traffic contract for a connection from an endpoint A to an endpoint B, identified by a path identifier, and carrying constant bit rate with given peak cell rates.

Connection control architecture

Connection control interfaces (Figure 10)

The centrally located connection control functions comprise the AAL type 2 connection processing (AAL2 control) and the SVC connection processing (SVC control). The SVC connections represent the pathes of AAL type 2 connections.

The signalling agent (SAG) and the related signalling link terminations (SLT) interface to AAL2 control, whereas ESIS and its protocol handler (PrH) will serve SVC control.

The interfaces to the access manager (AM) and network routing manager (NRM) are common to both AAL2 and SVC control.

Towards the periphery, AAL2 control interfaces with the connection identifier handler (CIH), which in turn handles the switching requests to the server cards TSC and

A2SC, whereas switching requests from SVC control take the path via the resource handler (RHS) towards A2SC and LIC. Alternatively CIH and RHS may be merged to a connection resource handler (CRH), commonly holding the interface to connection control and to the peripheral units.

SVC control has no interface with call control. The bearer control function (BCF) of a served user communicates with AAL2 control only.

There will be no direct interface between SVC and AAL2 control, for example via a message interface. The coupling is indirect via AM, which indeed decides when to set up or release an AAL type 2 path.

SVC control elements (figure 11)

Looking at the inner structure of SVC control according to figure 11, four subservices can be identified, each of them implemented as a state-event machine: A leg handler (LH) for incoming connection setup, a leg handler for outgoing connection setup, a leg controller (LC), and a connection resource agent (CRA).

The leg handlers communicate with the access manager for the purpose of resource allocation and deallocation at the access, and with CRA for issueing connect and disconnect request towards the periphery.

The leg controller coordinates routing towards NRM. Additionally LC has a special interface to AM, characterized by AM requests for setting up or releasing an AAL type 2 path.

The connection resource agent receives switching requests from the leg handlers. CRA builds up corresponding messages, and issues the requests to the proper connection resource handlers (CRH). Since these tasks require some coordination, especially in cases of premature connection releases, or alternative routing or rerouting attempts, CRA shall be a state event machine as well.

The subservice configuration depends on different connection setup scenarios, such as incoming, outgoing or transit connection setup. An incoming connection setup is represented by an incoming LH, LC and CRA, an outgoing connection setup by LC, an outgoing LH and CRA, a transit connection setup by all of them.

Synergy and functional split (figure 12)

Figure 12 displays a functional variant, where the elements of SVC and AAL2 control have a closer cohesion by putting them together within one SPU. There is still no direct interface between SVC and AAL2 control. Both of them could, however, use the routing function (here called network routing handler NRH) as a procedural interface. And both could commonly use PARC as the executing switching function towards the periphery.

We will leave it to analysis for further study, which model is more advantageous: Either to prefer a stricter functional split, or to gain synergies.

The access manager

Data structures

The access manager AM plays a central part in the AAL type 2 path switching mechanism. AM is dedicated to allocate and release resources for the setup and release of AAL type 2 connections carried by PVC and SVC pathes, as well as to allocate and release resources for the setup and release of SVC connections as the the pathes of AAL type 2 connections.

As a DBMS download unit, AM manages download data and transient data of accesses, virtual path connections (VPC, in the traditional ATM context), virtual channels (VC, switched or permanent), and AAL type 2 channels. This makes AM the overall access related resource holder, and puts it into a position to most efficiently decide, when AAL2 pathes need to be setup or released.

Figure 13 (ATM data structures) shows 4 hierarchical data object levels, starting from accesses via virtual path connections and virtual channel connections (the AAL type 2 pathes), down to the AAL type 2 channels. It is not intended here to give a complete data model. This is left to (pre)analysis. A few characteristics, as far as AAL type 2 path switching is concerned, shall however be highlighted.

From the viewpoint of SVC control, an access can be a UNI or an NNI (AINI) access. The threshold values, as needed for opportune path setup or release, could be attached to accesses or, alternatively, to VPCs.

Due to AAL type 2 path switching, the data object level 'VPC' is introduced. VPCs, like in classical ATM switching, may carry attributes such as traffic type (e.g. constant bit rate), maximum of allowed peak cell rates, SVC selection methods, or AAL type 2 traffic type (voice, data). Accumulated cell rates of active virtual channels are at least required as part of the transient data.

Switched VCCs do not have download data. Accumulated traffic data such as currently used cell rates or the number of active AAL type 2 channels need to be kept as transient data.

The third data type (lists, as indicated in the figure) comprises members of a data object. The term 'list' is to be understood in a common sense. The implemented data structures shall ensure that members can be searched, added, and deleted by use of their identifiers within efficient time.

Path selection

As a minimum requirement, the forward and backward sequential SVC assignment method has to be implemented. It is highly recommended[1], to implement a forward and backward circular assignment as well. Optionally, one may consider FIFO queuing mechanisms.

Path monitoring (figure 14)

The decision when to initiate a new path setup or path release is made by AM on a per call base, that is, whenever AM is called by AAL2 control to allocate or deallocate resources for an AAL type 2 connection setup or release. AM compares the currently consumed path capacity (accumulated cell rates, number of AAL type 2 channels) with given threshold values.

As Figure 14 shows If on allocating resources the threshold value for setup is exceeded, AM selects a new path, and sends a message to the leg controller of SVC control, requesting the setup of the path. SVC control confirmes the completion of path setup. Now AM may assign AAL type 2 channels to the new path.

Simularly, if upon deallocating the resources of an AAL type 2 connection the currently consumed path resources fall below the threshold value for release, AM requests the leg controller of SVC control to release a previously reserved, inactive path.

In general, one may tailor a threshold mechanism for the SVC selection method. Referring to the example above, a forward sequential selection is assumed, and AAL type 2 connections are assigned to the lowest path possible. Hence AM fills up from bottom to top, which makes the path on top the next candidate for release.

[1] due to some painful experience in the past

A threshold mechanism independent of SVC selection methods may be achieved, if one considers the sum of all active path resources, and defines the threshold values as distances to the available resources of all active pathes.

Path ownwership

Path monitoring as described above is performed by an AM which is allocating resources for an originating AAL2 connection endpoint. In this way AM becomes the owner of a path, and indeed may be considered as a user requesting path setup. The path owner eclusively allocates a path identifier. An AM verifying the requested AAL type 2 connection resources at the destination endpoint of a path must assume that the path owner monitors the path resources. Consequently, only the path owner may release the path.

Exceptional conditions

Within normal operation, the threshold mechanism shall ensure that path resources are provided in advance. There may occur situations however, where provision in advance cannot be guaranteed. Whenever a VPC is brought into service (again), triggered by administration or by call maintenance, there will be no path existing. With the mechanism above, this will be detected when AM needs to assign an AAL type 2 connection to a path. AM now requests path setup, but for the present must reject resource allocation to AAL2 control.

The problem could be overcome by automatically establishing a first path within a VPC as soon as AM receives the indication (from DBMS or possibly CAM) that a VPC is available for connection processing.

Another exceptional situation may occur, when extremely bulky traffic comes in within a short period of time.

As a general backup solution with a good chance not to loose the call, AAL2 control shall reattempt the connection setup after an appropriate delay, whenever it receives a rejection from AM indicating 'no path available, requesting setup'.

Routing

SVC and AAL2 control commonly use the same routing, ideally having the same routing interface.

The routing manager shall be able to deliver different routing result categories, such as 'local destination', if the path terminates in the own network element, or 'routing destination', if the path has to be routed further. The criteria to terminate the path may be based on translation of the called party number, or on comparison of the called party number with the own network element address.

Alternative routing capability shall be supported.

Path switching

The requests to connect or disconnect pathes are initiated by the leg handlers, and addressed to a connection resource agent (CRA), residing within SVC control (s. figure 15).

CRA maps the received information into messages towards the responsible resource handlers (we will call them CRH), sends the messages, receives the confirmations, and acknowledges to the leg handler.

The sample figure does not intend to dictate the message flow towards the periphery. Whether or not a sequentialization is required (as shown in the figure), depends on further analysis studies. For performance reasons, parallel tasks should be preferred whenever possible. If any coordinative functions are required, they shall be in hands of CRA.

Coordination (sequentialization) by CRA may be also necessary in cases, when the connection setup is aborted due to failures, either encountered by SVC control, or signalled by a partner service (AM or ESIS). The release procedures of the leg handlers then may request a premature disconnection, although previously issued connect requests are not yet completed.

Similar aspects matter when disconnecting a path as shown in the figure below. Certain path setup scenarios may require an automatic setup repeat attempt, or an alternative routing attempt. Due to performance reasons, the outgoing leg (represented by LH and ESIS instance) are released simultaneously to setting up a

new leg (with new LH and ESIS instances). Considering the activities towards the periphery, this means that disconnect requests are likely to be still on the way, when another connect request arrives at CRA.

Further analysis tasks need to precisely determine the data flows, the data being signaled or received from the access manager, transferred via CRA and CRH, and transmitted to A2SC and LIC (Figure 16). Furthermore, it needs to be analyzed, which transient data are to be kept during connection time by either CRA or CRH.[1]

[1] This is basically a question of functional split:
Which functional unit (SVC control or CRH) keeps connection related data as far as path switching is concerned ?

Figure 17 shows a (simplified) traffic flow through the ATM switching fabrics after having connected LICs to AAL type 2 server cards.

In the upper left corner, a path, externally identified by VPCI=a and VCI=b, has been switched through the LIC, and terminated on A2SC at endpoint x. The same has been done for an endpoint y, VPCI = c and VCI = d. The arrows are denoting the direction of call setup from the calling party towards the called party, but not necessarily the direction of path setup. This depends on the interface (radio or network interface), and in case of a network interface on the chosen type of forward or backward bearer establishment.

The dotted line with the internal endpoints u and v represents the AAL type 2 sphere of influence, which is not shown in detail here.

The lower part of the figure shows a classical ATM switching from LIC to LIC. This will be discussed lateron in a special chapter.

Basic path setup and release

We are now prepared to set up and release SVC pathes. The table in figure 18 gives a list of parameters used in the message flow charts.

Path setup at the originating endpoint (figure 19)

(1)

The decision to set up a new path is made by AM, triggered by an AM_ALLOCATE_IND from AAL2 control, and based on the implemented threshold mechanism. AM allocates the resources requested by AAL2 control, and determines that the threshold value is exceeded. Hence AM sends an SVC_SETUP_REQ message to the leg controller of SVC control. The message contains the source and target network element, represented by calling and called party number. These informations are given to AM by AAL2 control, and must be passed on to SVC control to assure that AAL type 2 connections and pathes take the same route through the

transport network. Furthermore, the message contains the connection characteristics, which are externally signalled, and which are needed to perform path switching towards the periphery.

(2)

The leg controller calls the network routing manager (NRM), providing it at least with the target network element. Certain connection characteristics, serving as additional route selection criteria, and the source network element may be provided as well. NRM returns a route (an access), which is included into the CMI_SETUP message sent to the leg handler.

(3)

The leg handler calls AM via SVC_ALLOCATE_IND, delivering the access and connection characteristics. AM assigns VPCI, VCI, and path identifier, and allocates the resources. LH inserts these data into the CMI_SETUP message to ESIS. Simultaneously, LH issues a connect request to CRA (see also chapter 'path switching').

(4) ESIS encodes the CMI_SETUP into a SETUP message, and sends it via its protocol handler to the adjacent network element. The arrival of a first backward message is monitored by a timer (as required by Q.2931). The decoded CONNECT message is passed on to LH.

(5)

LH awaits both the confirmation from CRA and the CMI_CONNECT message from ESIS, before reporting back to LC.

(6)

LC confirms the setup to AM, which now activates the path for the transport of AAL type 2 connections.

Path setup at the destination endpoint (figure 20)

(1)

ESIS receives a SETUP message from its protocol handler, decodes it, includes the access, and sends a CMI_SETUP to the leg handler of SVC control.

(2)
LH calls AM for verification of the path data (VPCI, VCI, path identifier). AM reserves the resources in accordance to the requested connection characteristics. On positive acknowledgement, LH passes the CMI_SETUP to the leg controller.

(3)
LC calls NRM, delivering source and target information, eventually including additional route selection criteria. NRM declares that the target has been reached. LC sets up a CMI_CONNECT message towards LH, containing an indication that the path is to be

(4)
Interpreting the termination flag, LH calls CRA, and requests the LIC to be connected to an A2SC. After having received the confirmation, LH passes the CMI_CONNECT to ESIS.

(5)
ESIS decodes the message, and transmits it over the succeeding link.

Path release at the originating endpoint (figure 21)

(1)
AM deallocates resources for an AAL type 2 connection, and finds out that the path resources fell below the release threshold value. AM calls the leg controller of SVC control to release the path.

(2)
LC sets up a CMI_RELEASE message, and sends it to LH.

(3)
LH passes the message to ESIS. Simultaneously, LH issues a disconnect request towards CRA.

(4)
ESIS sends a RELEASE message to its succeeding link, receives a RELEASE_COMPLETE message, and transmits a CMI_RELEASE_CNF to LH. The ESIS instance terminates.

(5)
LH coordinates the arrival of the disconnect confirmation from CRA with the arrival of

the CMI_RELEASE_CNF message from ESIS. If both messages are present, LH calls AM to release VPCI and VCI, (eventually also the path identifier), and to deallocate the resources of the path. If done, LH forwards the CMI_RELEASE_CNF to LC, and terminates.

(6)

LC confirms to AM (for further study if this message is omittable), and terminates. AM releases the path identifier (if not yet done on deallocation).

Path release at the destination endpoint (figure 22)

(1)

ESIS receives a RELEASE message from its adjacent network element, decodes it, and forwards a CMI_RELEASE message to LH.

(2)

LH informs LC.

(3)

LC reflects a CMI_RELEASE_CNF and terminates.

(4)

LH requests disconnection of the path from CRA. On positive reply, LH calls AM for deallocation of the resources. Finally LH acknowledges to ESIS and terminates.

(5)

ESIS sends a RELEASE_COMPLETE message over its external link and terminates.

Timers

ESIS provides timers as required by Q.2931.

When SVC control is triggered by AM to set up or to release a path, timing is required, and well positioned at the LC instance. The question to generally monitor communications with external services (out of own SPU), is left for further studies. Timers are helpful to obtain precise failure diagnostics in 'no response' cases[1].

Following pure design principles would require AM, as the initiator of a path setup or release, to use timers as well. Consequently, AM would become a state-event machine. To avoid this, a robust solution should be found, which relieves AM from timing.[2]

Transit path setup

Considering a path setup at the destination endpoint as shown in the chapter above, we let NRM state that the target network element has been reached. But what to do, if NRM responses with result category 'routing destination', indicating the path to be routed further. Principally there are three options to react on.

Option 1: The single hop solution

SVC control acts as if the routing result 'local destination' has been received, that is, the path is terminated within the network element. Providing eventually 'missing path links' towards the target network element is left to AM lateron, triggered by AAL2 connection setups originating in the given network element.

Option 2: The multiple hop solution

SVC control terminates the path within the network element, however continues to setup an outgoing leg. AM, upon receiving a request for path resource allocation, now decides to setup another path or not. If AM rejects with an indication 'Rejected, path available', SVC control releases the outgoing leg, and the job is finished. If AM accepts, SVC control continues to establish the path as usual. As a result, we have

[1] Explicit informations about not responding services are not directly available without timer monitoring. Under load, such failures are hard to locate.
[2] For further analysis. It is essential to eliminate the risk of deadlocks (consider the case of loosing an LC originated, confirming message to AM).

another path originating in the network element, and either terminating somewhere at an intermediate network element, or at the target network element.

Option 3: The transit solution

SVC control does not terminate the path in the network element. Instead, AM is called by the outgoing leg handler to allocate resources for a path, which is the same as the incoming one. Towards the periphery, SVC control switches through the path in the classical way, that is, from LIC to LIC as shown in the lower part of figure 17.

Claims

1. Method for transmission of information in paths of an ATM network

wherein a path setup for at least one new path in the network is initiated if the path capacity currently used for transmission of information exceeds a threshold (Fig. 14, setup threshold),

wherein a path release for at least one path in the network is initiated if the path capacity currently used for transmission of information is below a threshold (Fig. 14, release threshold).

2. Method according to claim 1

characterized in that the decisions on path setups and/or path releases are made when a new call or an other new data transmission is requested to be set up, wherein preferably for making an anticipatory decision the said capacity currently used for transmission of information includes the capacity necessary for the new call or data transmission.

3. Method according to any of the preceding claims

characterized in that the setup threshold and/ or the currently used path capacity represents accumulated cell rates.

4. Method according to any of the preceding claims

characterized in that the thresholds and/ or the currently used path capacity represent

the number of currently used ATM-channels in one path or in more than one path or in all paths.

5. Method according to any of the preceding claims

characterized in that the thresholds are preset values.

6. Method according to any of the preceding claims

characterized in that the thresholds are variable values that are administrated by the network.

7. Method according to any of the preceding claims

characterized in that the network is an ATM-AAL2 network.

8. Method according to any of the preceding claims

characterized in that the setup threshold exceeds the release threshold.

9. Method according to any of the preceding claims

characterized in that after setup of a path, ATM- channels can be assigned to the path.

10. Method according to any of the preceding claims

characterized in that the path capacity currently used for transmission of information is the current traffic in either one path or all currently used paths.

11. Method according to any of the preceding claims

characterized in that the setup and/or release threshold represents a minimum or maximum of a distance between currently used network resources and all available path resources.

12. Method according to any of the preceding claims

characterized in that a path is an ATM-VCC (ATM virtual channel connection).

13. Method according to any of the preceding claims

characterized in that a channel is an AAL2 channel.

14. Method according to any of the preceding claims

characterized in that after a setup of more than one path, a path is respectively occupied completely with ATM- channels before starting to occupy an other path with ATM channels.

15. Method according to any of the preceding claims

characterized in that a path release for at least one path in the network is initiated only if the path capacity currently used for transmission of information is below a threshold during at least a preset period of time or if it is on the average below a threshold during at least a preset period of time.

16. Device for transmission of information in paths of an ATM network

-with means for storing thresholds

-with means for determining the path capacity currently used for transmission of information

-with means for comparing the determined path capacity currently used for transmission of information and at least one stored threshold

-with means (Figure 10/ SVC control; access manager) that are designed for initiating a path setup for at least one new path in the network if the path capacity currently used for transmission of information exceeds a threshold (Fig. 14, setup threshold),

-with means that are designed for initiating a path release for at least one path in the network if the path capacity currently used for transmission of information is below a threshold (Fig. 14, release threshold).

17. Device according to claim 16

characterized in that the decisions on path setups and/or path releases are made when a new call or an other data transmission is requested to be set up, wherein preferably the said capacity currently used for transmission of information includes the capacity necessary for the new call or data transmission.

18. Device according to any of the preceding claims 16-17

characterized in that the thresholds and/ or the currently used path capacity represent accumulated cell rates.

19. Device according to any of the preceding claims 16-18

characterized in that the thresholds and/ or the currently used path capacity represent

the number of currently used ATM-channels in one path or in more than one path or in all paths.

20. Device according to any of the preceding claims 16-19

characterized in that the thresholds are preset values.

21. Device according to any of the preceding claims 16-20

characterized in that the thresholds are variable values that are administrated by the network.

22. Device according to any of the preceding claims 16-21

characterized in that the network is an ATM-AAL2 network.

23. Device according to any of the preceding claims 16-22

characterized in that the setup threshold for setup of at least one path is bigger the release threshold for release of at least one path.

24. Device according to any of the preceding claims 16-23

characterized in that after setup of a path, ATM- channels can be assigned to the path.

25. Device according to any of the preceding claims 16-24

characterized in that the path capacity currently used for transmission of information is the current traffic .

26. Device according to any of the preceding claims 16-25

characterized in that the setup and/or release threshold represents a minimum or maximum of a distance between currently used network resources and all available path resources.

27. Device according to any of the preceding claims 16-26

characterized in that it or a component of it is provided at an access point of an ATM network.

28. Device according to any of the preceding claims 16-27

characterized in that a path is an ATM-VCC (ATM virtual channel connection).

29. Device according to any of the preceding claims 16-28

characterized in that a channel is an AAL2 channel.

30. Device according to any of the preceding claims 16-29

characterized in that after a setup of more than one path, a path is respectively occupied completely with ATM- channels before starting to occupy an other path with ATM channels.

31. Device according to any of the preceding claims 16-30

characterized in that a path release for at least one path in the network is initiated only if the path capacity currently used for transmission of information is below a threshold during at least a preset period of time or if it is on the average below a threshold during at least a preset period of time.

Abstract

The invention discloses means and methods for transmission of information in paths of an ATM network wherein a path setup for at least one new path in the network is initiated if the path capacity currently used for transmission of information exceeds a threshold (Fig. 14, setup threshold), wherein a path release for at least one path in the network is initiated if the path capacity currently used for transmission of information is below a threshold (Fig. 14, release threshold). (Figure 14)

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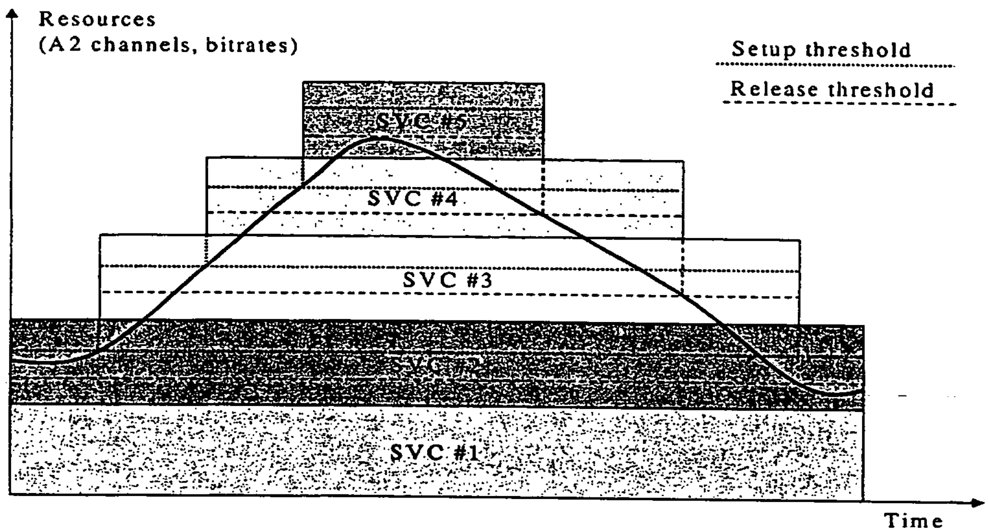


Figure 14: Path reservation

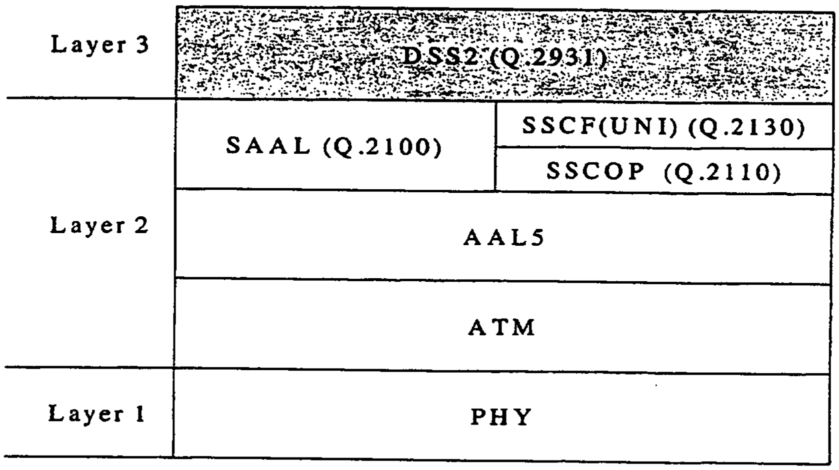
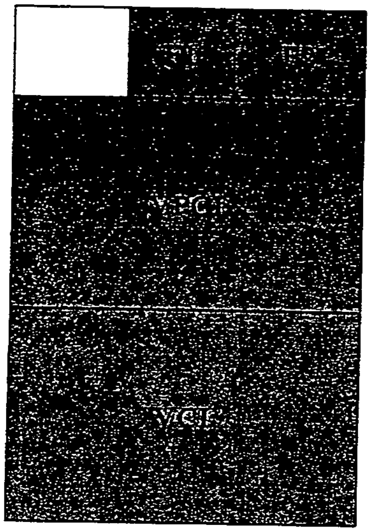


Figure 1: The DSS2 protocol stack



F1: Associated/non-associated signalling
F1 = 00: Associated signalling
F1 = 01: Non-associated signalling

F2: Preferred/exclusive assignment
F2 = 000: Exclusive VPCI, exclusive VCI
F2 = 001: Exclusive VPCI, any VCI

A missing connection identifier IE indicates any VPCI and any VCI.

Figure 2: The connection identifier information element

Protocol discriminator	Call reference
Message type	Message length
AAL parameters	Connection identifier
ATM traffic descriptor	QoS parameter
Broadband bearer capability	Generic identifier transport
Calling party number	Called party number
End-to-end transit delay	Transit network selection
Broadband high layer information	Broadband low layer information
Broadband repeat indicator	Broadband sending complete
Calling party subaddress	Called party subaddress
OAM traffic descriptor	Notification indicator

Figure 3: The setup message

AAL parameters	
IE header information	1-4
AAL type (= 2)	5
Maximum CPS-SDU size identifier	6
Maximum CPS-SDU size	6.1
Maximum number of multiplexed channels identifier	7
Maximum number of multiplexed channels (= 248)	7.1
SSCS type identifier	8
SSCS type (= 16, SAR according to I.366.1)	8.1
SAR parameters identifier	9
S1 | S2	9.1
Forward maximum SSSAR-SDU size identifier	10
Forward maximum SSSAR-SDU size	10.1 – 10.3
Backward maximum SSSAR-SDU size identifier	11
Backward maximum SSSAR-SDU size	11.1 - 11.3

Figure 4: AAL parameters

ATM traffic descriptor	
IE header information	1-4
Forward peak cell rate identifier (CLP 0+1)	7
Forward peak cell rate (CLP 0+1)	7.1 – 7.3
Backward peak cell rate identifier (CLP 0+1)	8
Backward peak cell rate (CLP 0+1)	8.1 – 8.3

Figure 5: ATM traffic descriptor

Broadband bearer capability				
IE header information				1-4
1	Spare (=00)	Bearer class (=BCOB-A)		5
1	F1=00	Spare (=000)	F2=00	6

Figure 6: Broadband bearer capability

Quality of service parameter	
IE header information	1-4
QoS class for the forward direction (= 0)	5
QoS class for the backward direction (= 0)	6

Figure 7: Quality of service

Generic identifier transport	
IE header information	1-4
Recommendation Q.2630 (= 9)	5
ATM VCC identifier (= 8)	6
ATM VCC identifier length (= 4)	6.1
AAL type 2 path identifier	6.2 – 6.5

Figure 8: Generic identifier transport

Calling/called party number			
IE header information			1-4
1	Type of number (=0)	Addressing plan (=AESA)	5
AESA octets			6.1 – 6.20

Figure 9: Party numbers

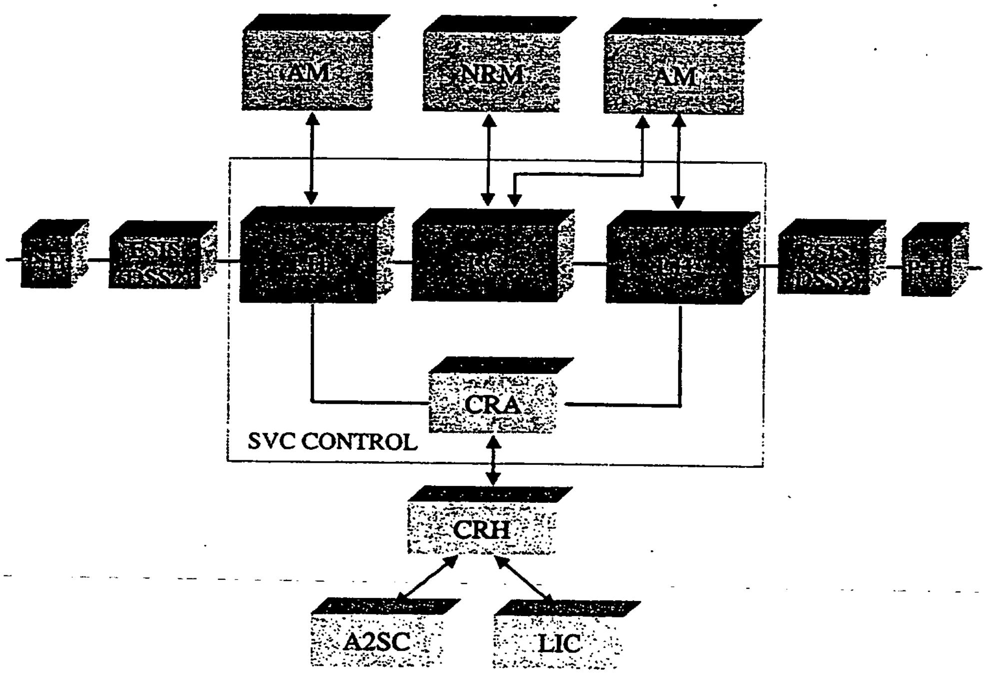


Figure 11: AAL2 control elements

0.1.1.1.1.1

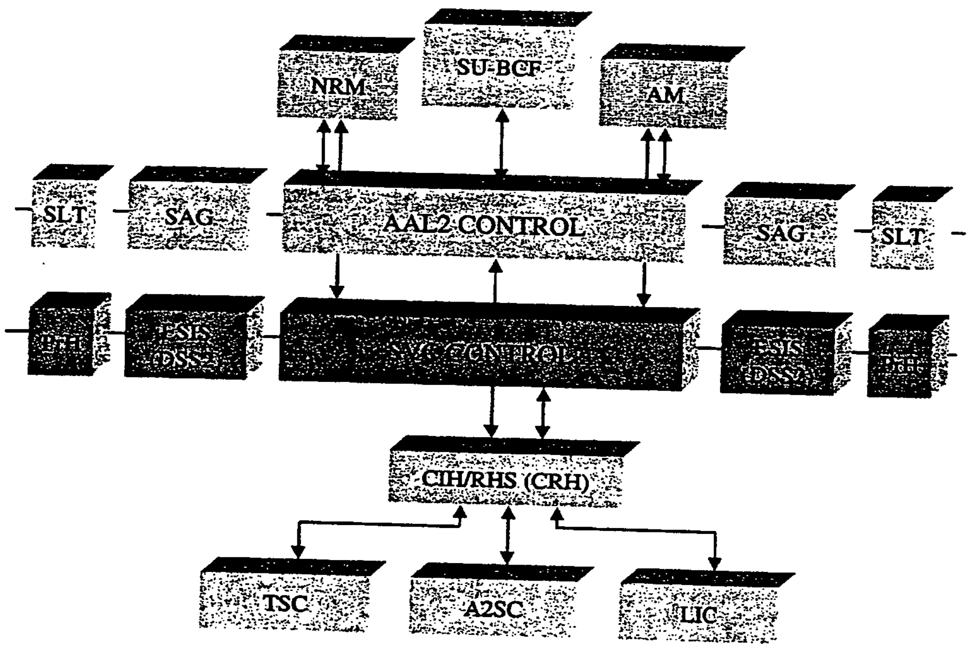


Figure 10: Connection

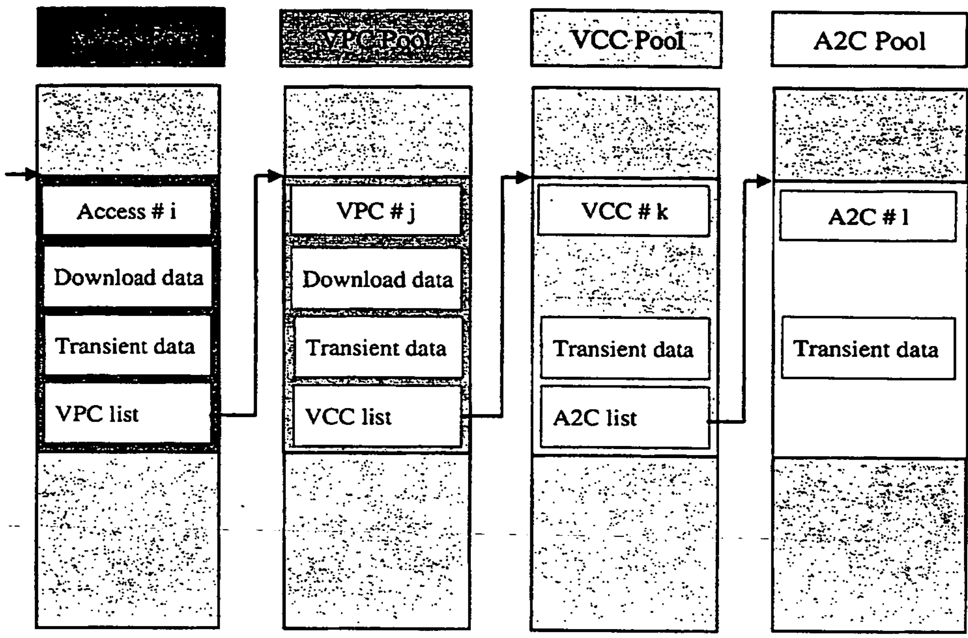


Figure 13: AM data structures

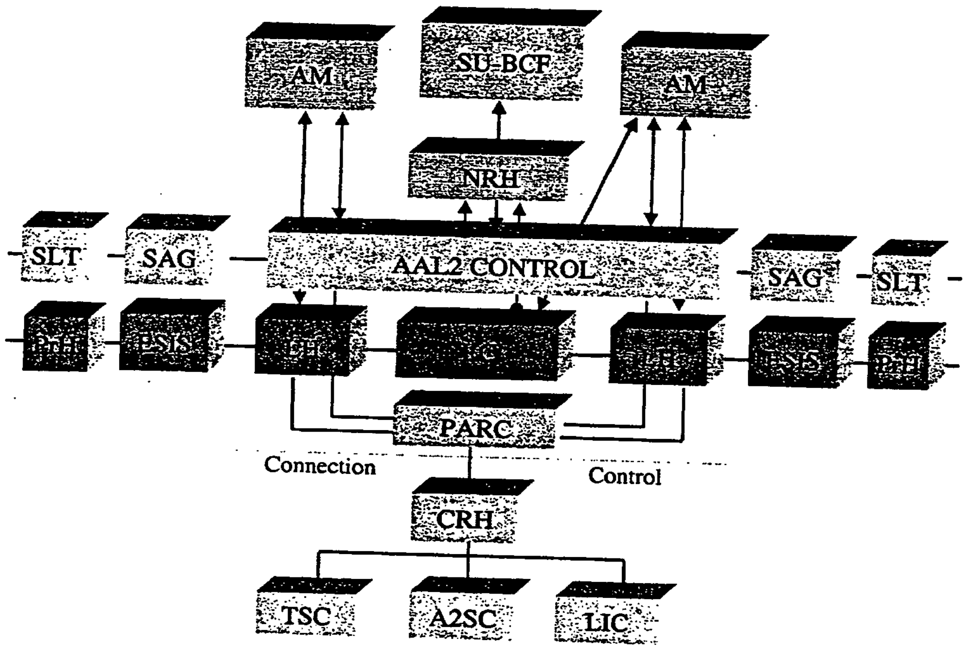


Figure 12: Synergy and functional split

0.1.1.1.2

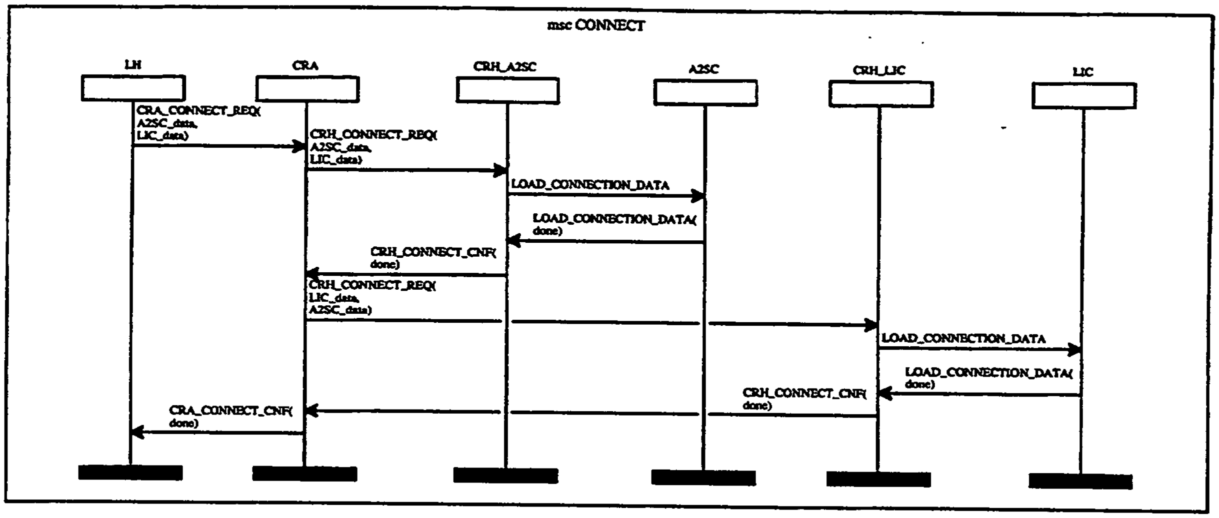


Figure 15: Connecting A2SC and LIC

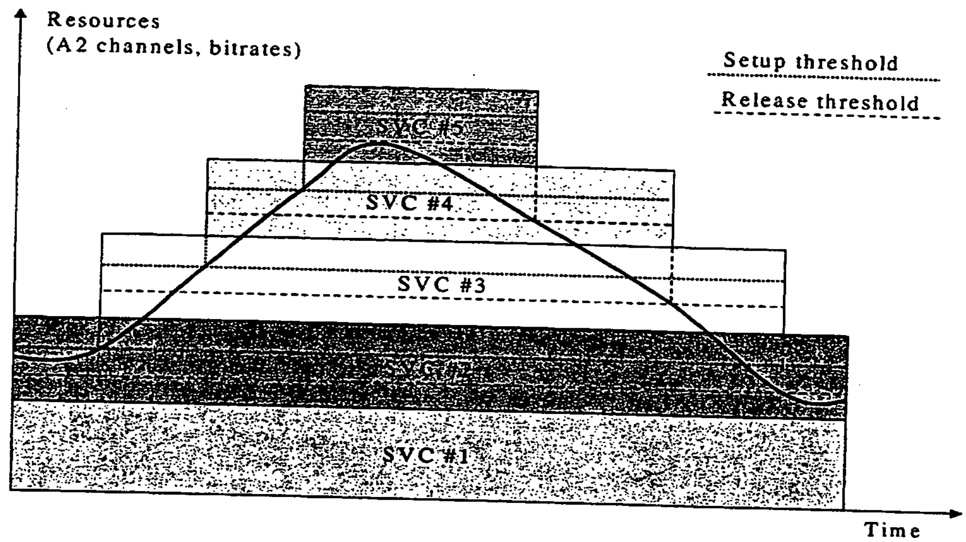


Figure 14: Path reservation

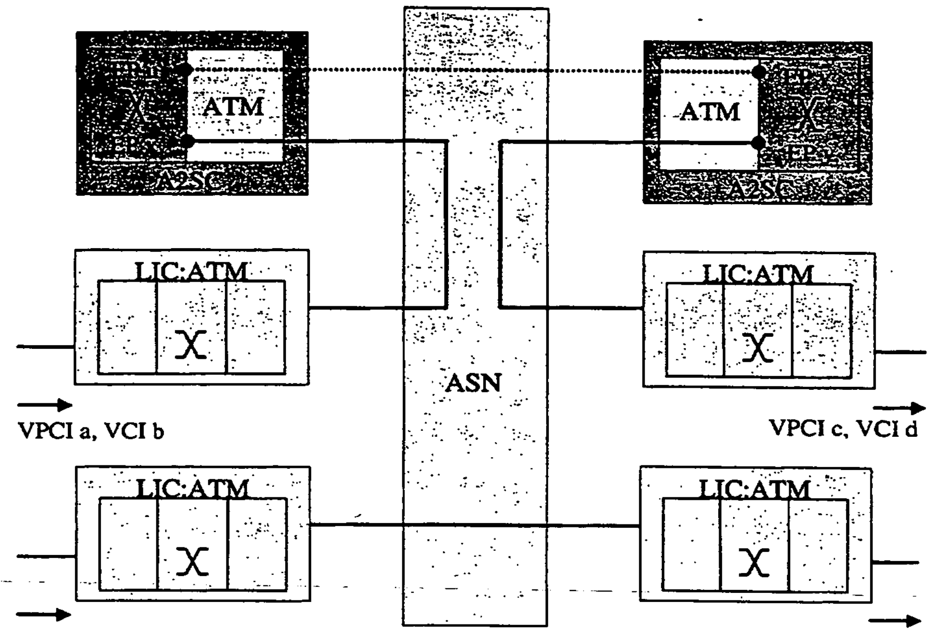


Figure 17: Traffic flow

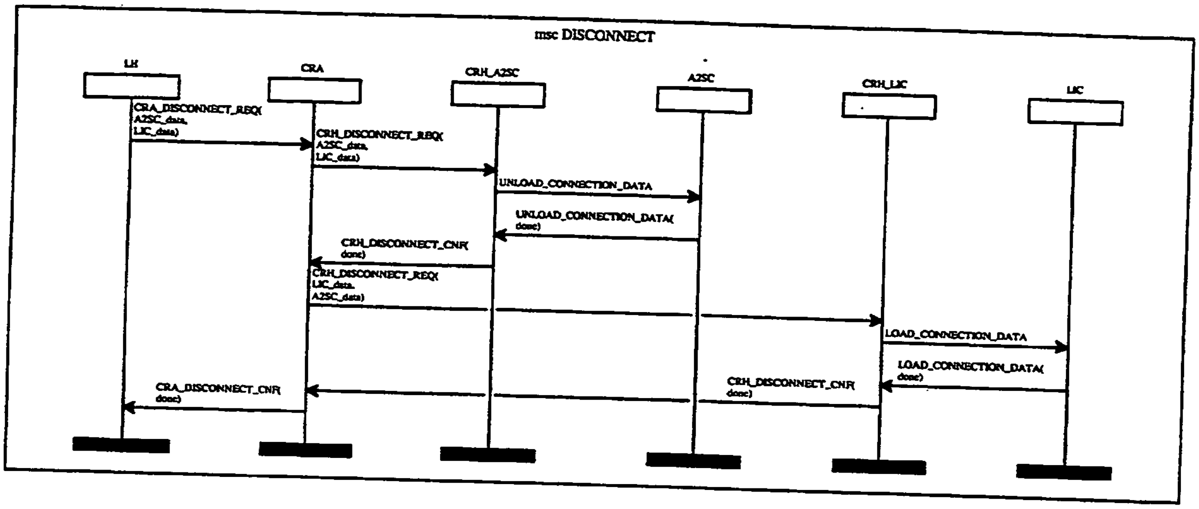


Figure 16: Disconnecting A2SC and LIC

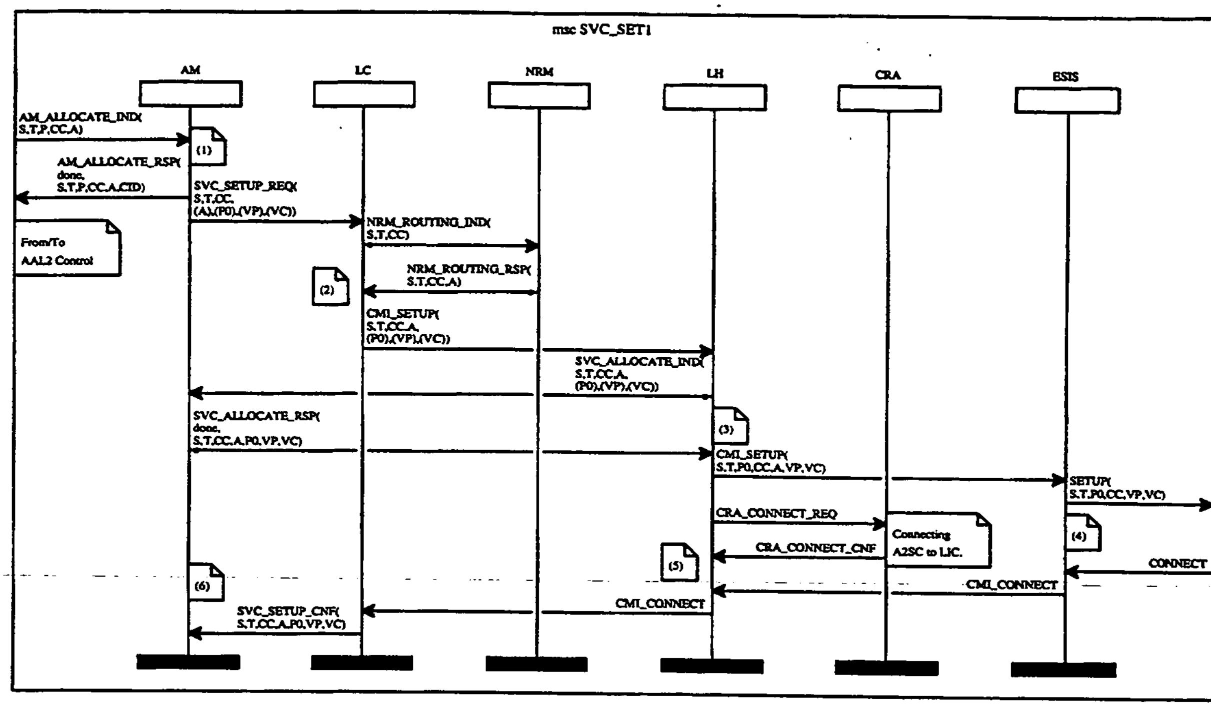


Figure 19: SVC path setup at the originating endpoint

Parameter	Meaning
S, S0, S1, S2	Source of the setup request (e.g. AESA address identifying a network element)
T	Target of the setup request (format as above)
CC	Connection characteristics: A set of parameters describing SVC connection characteristics (cell rates, traffic type, path type, AAL2 parameters, QoS parameters, etc ...)
P, P0, P1, P2	AAL type 2 pathes
A, A0, A1, A2	Accesses
VP	Virtual path, virtual path connection
VC	Virtual channel

Figure 18: Message parameters

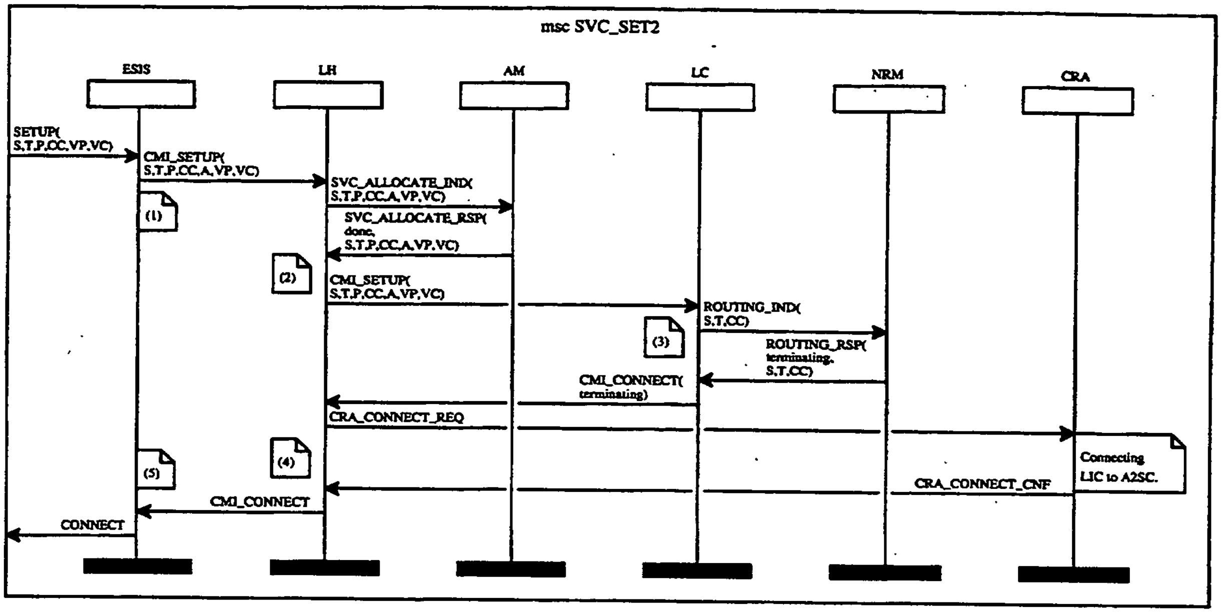


Figure 20: Path setup at the destination endpoint

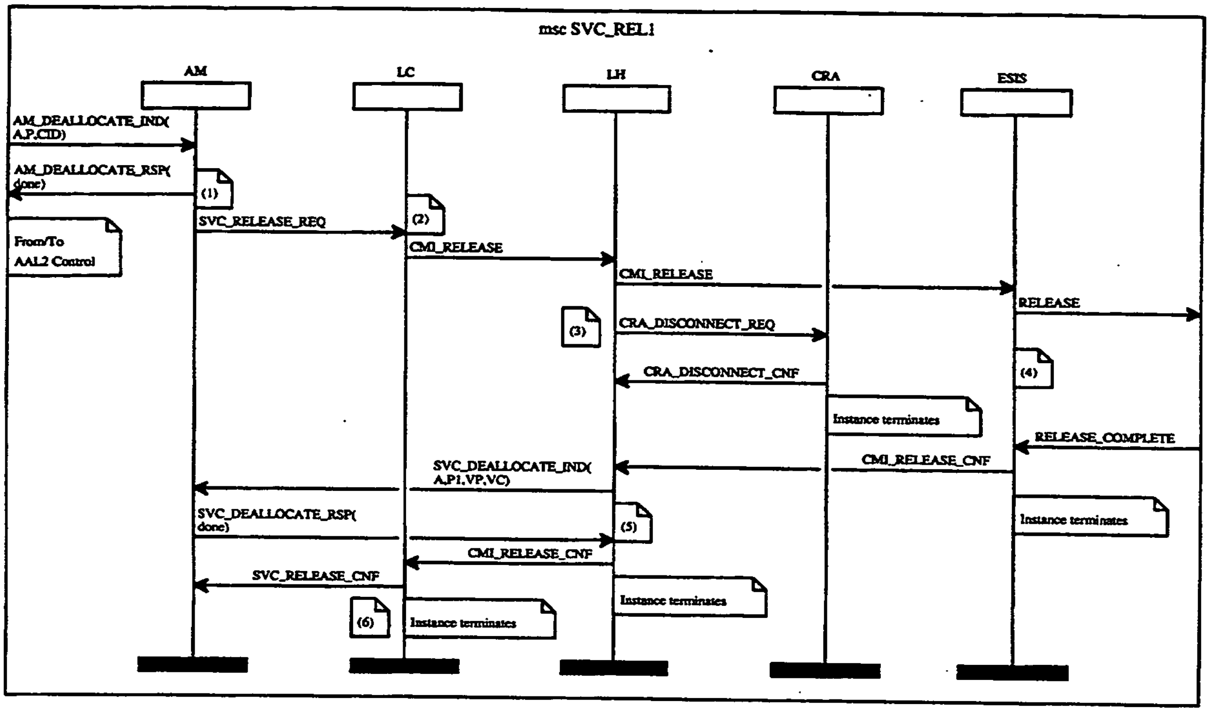


Figure 21: Path release at the originating endpoint

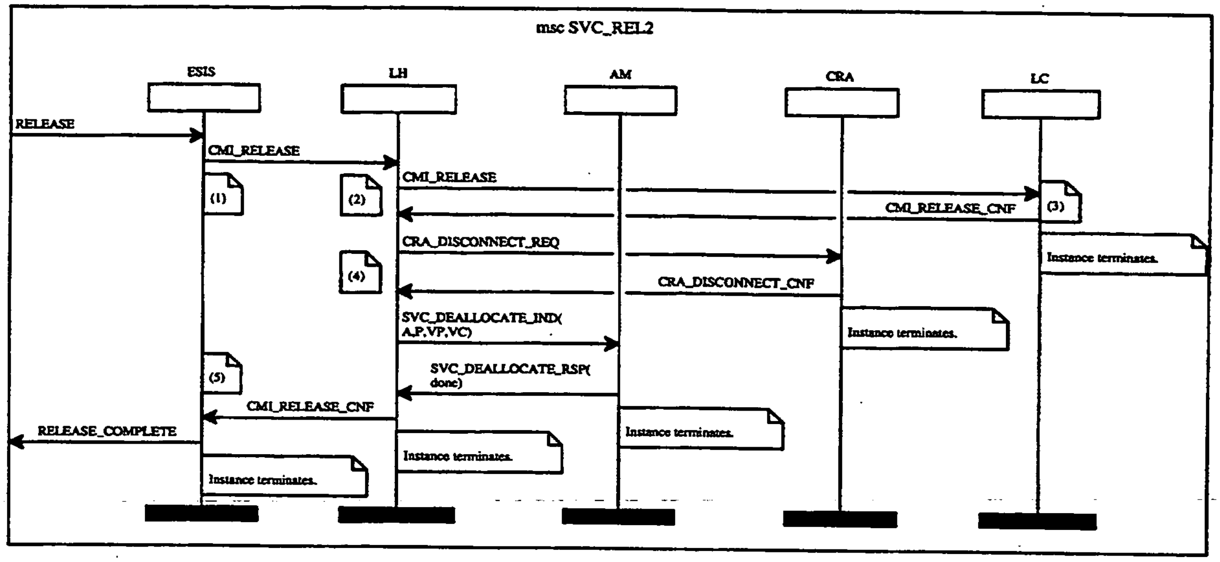


Figure 22: Pathe release at the destination endpoint

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